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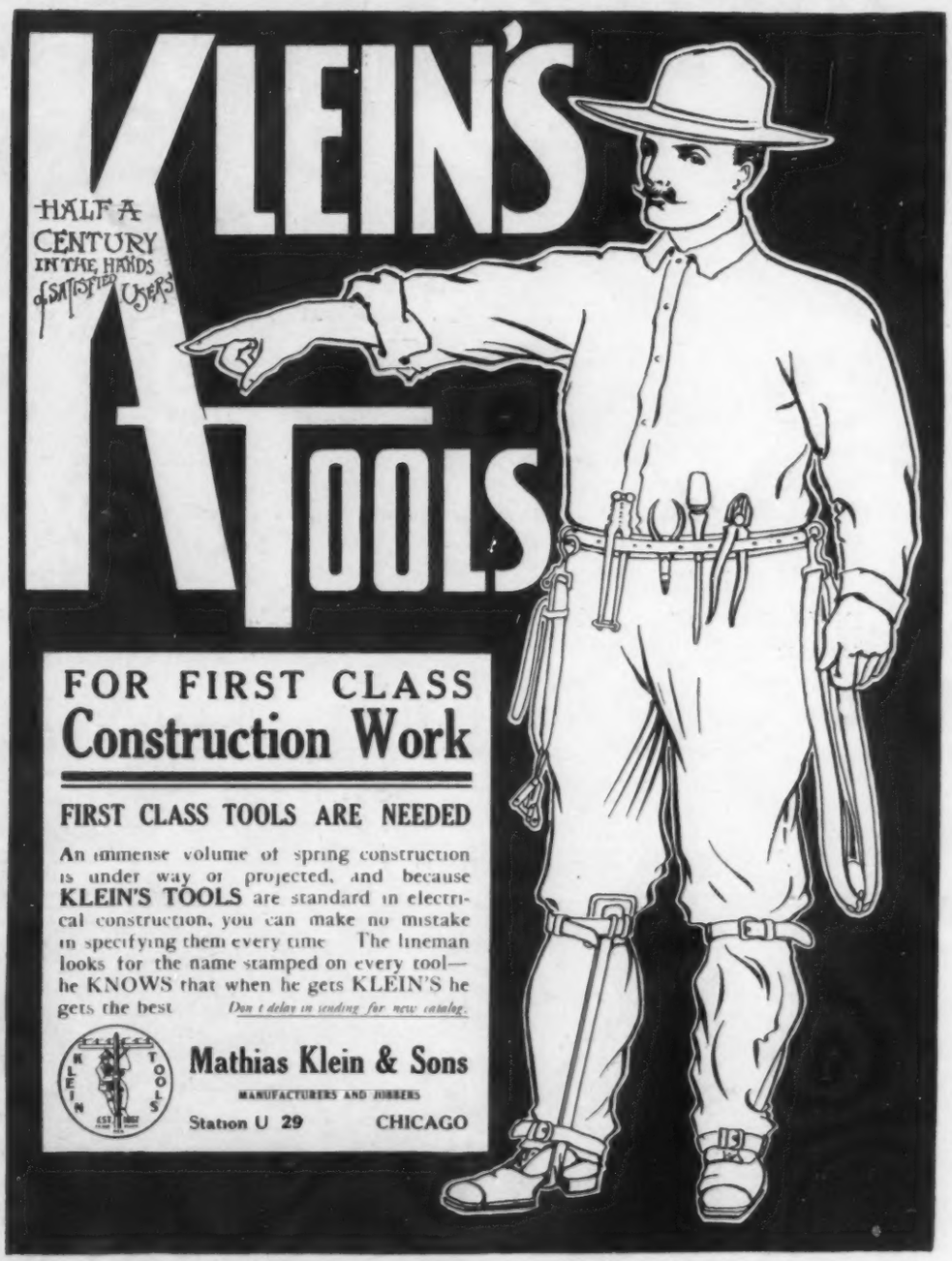
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WESTERN BOILER INSPECTION AND SUPERVISION

BY J. B. WARNER.[1]

A few years since very little was done in the effort of proper steam boiler inspection on the Pacific Coast outside of the boilers inspected by the United States government in the marine service.

For many years no particular rules or designs were followed in the construction of boilers, each factory or boiler shop designing and carrying out its own particular ideas, in many cases without reference to the most efficient form of construction. Owing to the fact that higher pressures were gradually demanded, better material, workmanship and construction became necessary.

The United States government, being the first to formulate rules and regulations in 1836, has gradually enlarged and developed these rules along more practical lines. At the present time, while the government laws are not all that might be desired, they are far ahead of those in operation a few years ago and are generally followed for stationary as well as marine purposes.

A Notable Boiler Explosion Near Sixteenth Street Depot, Oakland, California, in 1889.

The first systematic boiler inspection on the Pacific Coast was inaugurated about 1884 through the efforts of the boiler insurance companies. Since that time, the larger portion of the steam users have availed themselves of the advantages to be derived along these lines.

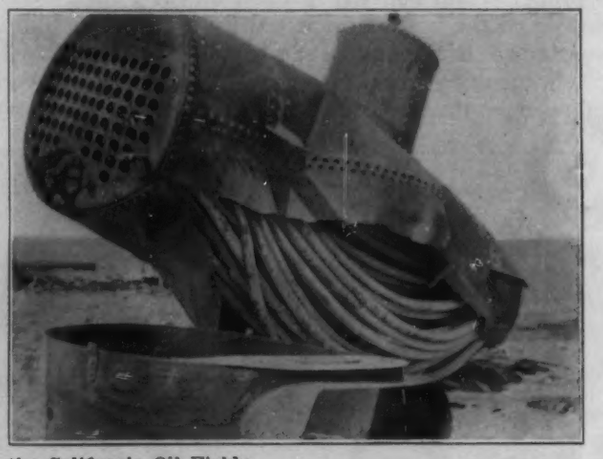
The number of steam boiler explosions on the

[1]Chief Inspector San Francisco department, Hartford Steam Boiler Inspection and Insurance Company.

Pacific Coast in proportion to the number of boilers used in the earlier period was excessive, but owing to the fact that most of the boilers are now periodically inspected, the number and proportion of explosions has been materially reduced.

The demand for higher steam pressure has developed a better class of material and workmanship and with the use of the knowledge gained by experience suitable rules have been formulated for the design and construction of boilers. The safety factors have been increased so that at the present time, if the boilers are properly constructed and handled and the pressure kept within the proper safety limit, the liability of explosion is less than in former days. The aggregate of the boiler horsepower on the Pacific Coast has doubled within the last 15 or 20 years, but the number of explosions have been reduced.

We append a summary of the boiler explosions in the United States as reported in the "Locomotive," from 1879 to date:



A Recent Boiler Explosion in the California Oil Fields.

A Summary of Boiler Explosions, From 1879 to 1911, Inclusive.

Year.	Number of Explosions	Persons Killed.	Persons Injured.	Persons Kiled and Injured.
1879	132	208	213	421
1880	170	259	555	814
1881	159	251	313	564
1882	172	271	359	630
1883	184	263	412	675
1884	152	254	251	505
1885	155	220	278	498
1886	185	254	314	568
1887	198	264	388	652
1888	246	331	505	836
1889	160	304	433	737
1890	226	244	351	595
1891	257	263	371	634
1892	269	298	442	740
1893	316	327	385	712
1894	362	331	472	803
1895	355	374	519	893
1896	346	382	529	911
1897	369	398	528	926
1898	383	324	577	901
1899	388	298	456	754
1900	373	268	520	788
1901	423	312	646	958
1902	391	304	529	833
1903	383	293	522	815
1904	391	220	294	614
1905	450	383	585	968
1906	431	235	467	702
1907	471	300	420	720
1908	470	281	531	812
1909	550	227	422	649
1910	533	280	506	786
1911	504	223	420	643
Totals	...10,569	9,444	14,613	24,057

The records of the explosions on the Pacific Coast for the same period are as follows:

Boiler explosions	450
Persons killed	650
Persons injured	923
Total killed and injured	1573

In previous years wood and coal were used almost exclusively for fuel. At the present time oil has taken their place, both in land and marine work. While oil is more severe than wood and coal on a boiler if improperly used, it gives good satisfaction under proper management and will develop a greater amount of power in a given size boiler, owing to the fact that there is a steady fire which is generating steam at all times. With wood or coal as fuel it is necessary to replenish the fires, allowing a large amount of cold air to enter the furnaces which is not only detrimental to the steaming qualities but also very hard on the boiler itself, due to the sudden contraction of the plates and other parts of the boiler. With the oil fires, the admission of cold air is practically excluded from the furnace so that the boiler is kept expanded at all times, making the liability of rupture through undue contraction much less.

Owing to the higher pressures demanded, due to the use of compound, triple expansion, and turbine engines, the construction of the boilers has been materially improved and their efficiency increased. The material entering into boiler construction is of a much superior quality than in former years. The rules for construction are better understood so that taken as a whole results are being obtained today that were impossible a few years ago.

The cause of a boiler explosion is generally attributed to low water, since in most cases, the actual cause of explosion, is not known or hard to determine this appears to be the easiest excuse or explanation of the phenomenon. But in a large majority of the explosions, after careful and thorough investigation, we find that there are many other reasons which cause disastrous results, among which are: internal and external corrosion, development of cracks along the longitudinal seams, along the sides of the boilers, owing to the fact that lap seams are used instead of butt-strip. Whenever a lap seam is used there is an off-set in the sheet and usually a flat surface in the side of the boiler which when under pressure has a tendency to form into a cylindrical shape. This causes a hinge motion which by continual use soon develops cracks, causing the sheets to let go.

Scale and oil in the boilers often keep the water from coming in contact with the internal surface, allowing the fire to overheat and weaken the material to such an extent that it bulges and oftentimes ruptures. Defective safety valves, water gauges and other fittings are also conducive to over pressure, low water, or some other cause, which necessitates the boiler withstanding a greater pressure than it should.

Defective Furnaces From S.S. "City of Everett," San Francisco Bay.

Leaky blow-offs often allow the water to get out of the boiler during the night so that the watchman or fireman whose duty it is to put fires under the boilers, do so when the water is either low or entirely out of them. This allows the sheets to be overheated and often causes great trouble or disastrous results. Suitable and tight blow-offs are very important in the safe and economical running of a boiler plant. Oftentimes the lower connection to the glass water gauge becomes choked with sediment so that the water stands in the glass and, owing to the condensation, the glass gradually fills (as the water cannot back into the boiler) while the water in the boiler itself is lower so that the fire sheets become exposed, overheated and let go.

In order to reduce and minimize the number of boiler explosions, loss of life, personal injury, and loss to property, the inspectors from time to time have formulated and put into operation suitable rules which are followed and recognized at the present time as an authority on the construction and management of boilers. These have done a great deal to reduce the number of explosions and loss of life throughout the country, and are as follows:

Boiler Room Instructions.

Whenever going on duty in the boiler room, find out, first of all, where the water level is in the boilers. Never unbank nor replenish the fires until this is done. Make sure that the gage glass and gage cocks, and all the connections thereto, are free and in good working order. Do not rely upon the glass altogether, but use the gage cocks also, and try them all, several times a day.

Before starting up the fires, open each door about the setting and look carefully for leaks. If leaks are discovered, either then or at any other time, they should be located and repaired; but cool the boiler off, first. If leaking occurs at the fore-and-aft joints, the inspecting company should be notified at once. This is important, whether the attendant considers the leakage serious or not; and it is especially important when the boiler has a single bottom sheet, or is of the two-sheet type.

When a boiler has been emptied of water, do not fill it again until it has become cold.

In preparing to get up steam after the boiler has been out of service, be sure that the manhole and handhole joints are tight. Do not use gaskets that are thin and hard.

Vent the boiler in some way, first, to permit the escape of air. Then fill the boiler to the proper level, open the dampers, and start the fires. Start them early, so as to have the pressure up at the required hour, without forcing.

Ventilate the setting thoroughly before lighting the fire. Never turn on the fuel supply when starting up, nor after the snapping out of a burner, without first placing in the furnace a lighted torch or a piece of burning waste, to ignite the fuel instantly.

In firing up a boiler that is to be connected with others that are already in service, keep its stop-valve closed until the pressure within the boiler has become exactly equal to that in the steam main. Then open the stop valve a bare crack, and slowly increase the opening until the valve is wide open. The complete operation should occupy two minutes or more. Close the valve at once if there is the slightest evidence of any unusual jar or disturbance about the boiler. See that the steam main to which the boiler is to be connected is thoroughly drained before the valve is opened.

In case of low water, immediately cover the fire with ashes or fresh coal. Close the ash-pit doors and leave the fire doors open. If gas or oil is used as fuel, shut off the supply from the burners. Don't turn on

Defective Boiler Dredger "Thor," March, 1912.

the feed under any circumstances, and don't open the safety-valve nor tamper with it in any way. Let the steam outlets remain as they are. Get your boiler cool before you do anything else.

No repairs of any kind should be made, either to boilers or to piping, while the part upon which the work is to be done is under pressure. This applies to

calking, to tightening up bolts under pressure, and to repairs of any kind whatsoever.

The safety-valve must not be set at a pressure higher than that permitted by the insurance company's policy. Try all safety-valves cautionsly, every day. If the actual blowing pressure, as shown by the gage, exceeds the pressure at which the valve is supposed to blow, inform the office immediately, so that prompt notice may be sent to the company. The safety-valve pipe should never have a stop-valve upon it.

To remove sediment from the bottom of the boiler, open the blowoff valve in the morning, or before the circulation has started up. The valve should be opened wide for a few moments, but it should be opened and closed slowly, so as to avoid shocks from water-hammer action. When surface blowoffs are used, they should be opened frequently, for a few minutes at a time.

In case of foaming, check the draft and cover the fires with fresh coal, or shut off the burners if oil or gas is used as fuel. Shut the stop-valve long enough to find the true level of the water. If this is sufficiently high, blow down some of the water in the boiler, and feed in some fresh. Repeat this several times if necessary. If the foaming does not stop, cool the boiler off, empty it, and find out the cause of the trouble.

Cylinder oil must be kept out of the boilers, because it is likely to cause overheating of the plates. Oily deposits may be removed, in large measure, by scraping and scrubbing, although more efficient methods of treatment may be required in bad cases. If kerosene is used in a boiler, keep all open lights away from the manholes and handholes, both when applying the kerosene, and upon opening the boiler up afterwards; and ventilate the inside of the boiler thoroughly, after oil has been used in it.

Fusible plugs should be filled with pure tin. They should be renewed or refilled as often as may be necessary to keep them in good condition.

Clean the fires before banking, push them back against the bridge wall, and cover them well with fresh coal. Keep the ash-pit doors closed, and open the fire doors a crack. Keep the damper nearly closed, but do not close it tight.

In cooling a boiler before emptying it, first let the fire die out, and then close all doors and leave the damper open until the pressure falls to the point at which it is desired to blow. Clean the furnace and let the brickwork cool for at least two hours before opening the blowoff valve. If it is desired to cool the boiler further, after it has been emptied open the manhole and leave everything else as in full actual service,—the fire doors, front connection doors, and cleaning doors being closed, and the damper and ash-pit doors open.

First cool the boiler as explained in the last paragraph. Never blow out under a pressure exceeding ten or (at most) fifteen pounds by the gage.

The engineer must find out for himself how often his boilers need to be opened and cleaned. In many plants it is necessary to clean every week, while in some favored few it is sufficient to clean every three months. When using kerosene or large amounts of scale solvent, or when (as in the spring-time) the water becomes unusually soft, the boilers must be opened oftener than usual. In washing out a boiler, wash the tubes from above, as well as from below.

Never touch any valve whatsoever, in any part of the room, while a man is inside of a boiler, nor even after he has come out again, until he has reported that his work is finished and that he will not enter the boiler again. It is well to lock the stop-valve and blowoff valve upon every boiler in which a man is working, while other boilers are under steam. Padlocks and chains may be used for this purpose.

In water-tube boilers the covers opposite the three rows of tubes nearest the fire should be taken off once a month, and the tubes thoroughly scraped and washed out; and all the tubes should be thoroughly scraped and washed out at least once in four months. This is for water of average quality. If the water is bad, clean the tubes oftener.

When mechanical hammers or cleaners are employed for removing scale from tubes, the pressure used to operate them should be as low as will suffice to do the work. Do not allow the cleaner to operate for more than a few seconds upon any one spot, and see that it goes entirely through the tube. Avoid high temperatures in the steam or water used to operate the cleaner.

In putting a boiler out of service, it should be cooled, emptied, and thoroughly cleaned, both inside and outside. The setting should likewise be cleaned in all its parts. Leave the handhole covers and manhole plates off. After washing the interior of the boiler, let it drain well. Then see that no moisture can collect anywhere about the boiler, nor drip upon it either internally or externally. Empty the siphon below the steam gage if the boiler room is likely to be cold, or take the gage off and store it safely away.

Do not allow moisture to come in contact with the outside of the boiler at any time, either from leaky joints or otherwise. Keep the mud drums and nipples, and the rear ends of horizontal and inclined tubes in water-tube boilers, free from sooty matter. If internal corrosion is discovered, notify your employers at once.

Examine your boilers carefully in all their parts, whenever they are laid off, and keep them as clean as possible, both inside and outside. See that all necessary repairs are made, promptly and thoroughly. Keep the water glass and pressure gage clean and well lighted. If any contingency arises that you do not understand, report the matter to your employers at once; and if you think it possible that serious trouble may be impending at any time, shut down the boiler immediately.

Inform yourself respecting any local laws or ordinances relating to the duties of engineers and firemen, or to the plant in which you work. If there be any such, attend to them faithfully.

PUBLIC WELFARE EXPOSITION.

A public welfare exposition of pure foods, sanitary, safety and building appliances for improving the conditions of home life, and assisting those engaged in public work and improvements, will be held at the University of California at Berkeley, Sept. 23 to 28. There will also be exhibits of machinery and supplies used in the administration of municipal government.

WESTERN LAWS OF ELECTRICITY AND WATER

COMMERCIAL IRRIGATION ENTERPRISES.

BY. A. E. CHANDLER.

A study of the historical development of irrigation in the western states shows that the small mountain streams along the overland trails and at or near the trading posts were the first to be used for agricultural purposes. As mines were discovered and operated the waters of the streams in the larger valleys were diverted by simple ditches on the lower or bottom lands. Later two or more settlers joined in the construction of larger ditches for the irrigation of land higher up on the stream, and in this way all easily accessible lands in the valley were irrigated. These individual and partnership ditches were sufficient for the lower lands.

It soon became known that the higher, or mesa lands were better than the bottom lands, but the problem of digging ditches to them offered too many difficulties for local accomplishment. It was at this point that eastern and foreign capital was secured for the construction of irrigation canals to reach the higher lands. The size and number of such systems built during the eighties indicate that the promoter had an easy task, and when we consider the time and results of the early irrigation his success must be taken as a matter of course. The simple ditches then in use were the single instrument by which land worth nothing had been brought into a high state of cultivation and great value. It was easy therefore to picture the rich returns of thousands of acres of such land, now barren and worthless, when under a well constructed canal. No argument was necssary to convince the investor that the real wealth lay in the water and that a system of selling water for irrigation was better than a gold mine.

We now know that most of the systems thus built were financial disasters and that the failure was not due to either lack of land or water, or want of engineering skill. The chief error was the neglect to "tie" the land to the water. The promoters and investors were right in believing that the land without the water must remain valueless, but they erred in thinking that the settlers on the land under the system would promptly take water on any terms dictated. The settler, unfortunately, was in most cases a mere "sooner," a waiter of fortune who hurried to the choice land, there to stay until bought out by the real home builder. During the eighties most of the land to be covered by the larger systems was government land and there were no statutes by means of which the canal company could protect itself against filings by "sooners" or secure a lien upon the land for its unpaid water charges. Every western state affords illustrations of large sums lost to its investors in such irrigation enterprises (now called commercial enterprises) and intelligent capital today will invest in no scheme where land and water do not go together. In fact, the attractive enterprise today is really a land deal to which the construction of the irrigation system is but incidental.

The following table (from the census statistics) shows the total area irrigated in 1909, the area irrigated in 1909 by commercial enterprises, and the percentage of the total irrigated by the latter. The commercial enterprise differs from the mutual or co-operative enterprise in that the former supplies water for compensation to parties having no interest in the works and the latter supplies water to stockholders only.

Acreage Irrigated in 1909.

State.	Total.	Commercial Enterprises.	Percentage by Commercial Enterprises.
Arid States	13,739,499	1,444,806	10.6
California	2,664,104	746,265	10.6
Washington	334,378	66,911	20.0
Texas (exclusive of rice)	164,283	73,440	16.3
Oregon	686,129	77,387	11.3
South Dakota	63,248	6,300	10.
Nebraska	255,950	24,834	9.7
Wyoming	1,133,302	87,935	7.8
Utah	999,410	70,227	7.0
Colorado	2,792,032	159,457	5.9
Montana	1,679,084	62,544	3.7
New Mexico	461,718	15.690	3.4
Idaho	1,430,848	44,872	3,1
Nevada	701,833	8,864	1.3
Arizona	320,051	80	.1
Kansas	37,479	.....	....
North Dakota	10,248	.....	....
Oklahoma	5,402	.....	....

As California has comparatively so large a percentage of commercial enterprises, it might be inferred that such projects are especially numerous and popular. The fact is, however, that the large acreage so served is under a small number of unusually extensive systems and that the mutual systems are the rule.

The commercial enterprises may be divided into three groups as follows:

First. Enterprises furnishing water on annual rental basis only;

Second. Enterprises selling water rights and charging either a fixed or variable annual rate in addition;

Third. Enterprises selling water rights and a pro rata interest in the irrigated system. The enterprises of this group therefore become mutual enterprises.

A few California examples of each group follow:

Examples of Companies "Renting" Water.

The Kern County Land Company diverts water from the Kern River for the irrigation of about 250,000 acres in the vicinity of Bakersfield. Although most of the water is used to irrigate its own lands, the company controls sixteen subsidiary canal companies. Water is supplied at the rate of 75 cents per cubic foot per second, flowing for 24 hours—equivalent to 37.5 cents per acre foot.

The San Joaquin and Kings River Canal and Irrigation Company diverts water from the San Joaquin River for the irrigation of about 100,000 acres on the west side of the San Joaquin Valley in Fresno, Merced and Stanislaus Counties. The water rate has been fixed by the Boards of Supervisors as follows:

Stanislaus County	$2.35	per cu. ft. per sec. for 24 hrs.
Merced County	1.90	" " " " " " " "
Fresno County	1.25	" " " " " " " "

The Pacific Gas & Electric Company owns and operates a number of canals diverting water from the

Yuba and Bear Rivers in Placer County. The canals were formerly used for hydraulic mining but are now used for irrigation and municipal supply. No water rights are sold but the rates for the various kinds of service are fixed annually by the County Supervisors.

Examples of Companies Selling Water Rights But No Interest in System.

The San Diego Land and Town Company owns the Sweetwater reservoir and canal system in San Diego County. It has sold land under its system with and without a water right, has sold water rights to other lands, and has furnished water on a rental basis to lands having no water right.

The California Development Company diverts water from the Colorado River for the irrigation of about 225,000 acres in the Imperial Valley. It has contracted with several mutual companies to supply water at the rate of 50 cents per acre foot—4 acre feet being sufficient for one acre. The mutual companies sell water rights on the basis of one share of stock to the acre, at the rate of $15 to $25 per acre, which amounts must be paid to the California Development Company. The water user pays an additional sum of about 20 cents per acre to the mutual companies for maintenance and operation.

The Fresno Canal & Irrigation Company and the Consolidated Canal Company are under the same management and divert water from the Kings River for the irrigation of about 360,000 acres in Fresno County. Water rights are sold at the rate of $10 per acre for first class rights under the Fresno Canal and Irrigation system and $5 per acre for second class rights under that system and rights under the Consolidated. The rights are on the basis of one cubic foot per second to 160 ocres. There is an additional annual charge of 62.5 cents per acre under the Fresno and 75 cents per acre under the Consolidated.

The Crocker-Huffman Land & Water Company diverts water from the Merced River for the irrigation of about 60,000 acres in the vicinity of Merced. Water rights on the basis of one cubic foot for 160 acres, are sold at the rate of $10 per acre, with an additional annual maintenance charge of $1 per acre.

Examples of Companies Selling Water Rights Carrying an Interest in System.

The Patterson Land Company diverts water from the San Joaquin River for the irrigation of 19,000 acres on the "West Side" in Stanislaus County—all owned by the company. The irrigation system has been transferred to the Patterson Water Company. Water rights on the basis of 2 to 3 acre-feet per acre are sold with the land at prices from $200 to $500 per acre. An additional annual charge of $3 for 2 acre feet and $1.50 for the extra acre foot is made. A share of stock in the water company is given with each acre sold, but the land company will retain management until 75 per cent of the land is sold, after which the land purchasers will be given control.

The Sacramento Valley Irrigation Company has purchased the old Central Canal and is extending the canal and lateral system to cover about 150,000 acres on the "West Side" in Glenn and Colusa Counties. The company is a land company and is purchasing all the irrigable land under the line of canal which it can secure. The Sacramento West Side Irrigation Company has been formed to operate the system. Water rights on the basis of 1½ acre feet per acre will be sold with the land at prices from $125 per acre upwards. An additional annual operation and maintenance charge will be made. A share of stock in the West Side Company will be given with each acre of land, so that the land purchasers will ultimately operate and manage the system.

Most of the larger mutual companies in southern California were started as commercial enterprises of this group. There is probably no better example than the Gage Canal which is known as one of the most highly developed systems in the country. It diverts water from the Santa Ana River for the irrigation of about 10,000 acres near Riverside. The Riverside Trust Company originally owned the land and canal system. Each acre sold carried a water right of one-fifth of an inch and two shares in the Gage Company.

The Colorado Anti-Royalty Act.

In the early eighties a number of canal systems were built in Colorado which sold water rights and also charged an annual rate. This custom was stopped by the so-called Anti-Royalty Act of 1887, which made it unlawful for a ditch owner to accept payment corresponding to that for our right before supplying water at the annual rate. To evade the provision of the Act water rights were sold providing that when water rights amounting to the estimated capacity of the canal were sold, the company would transfer the system to a new company formed exclusively of water users. In the early days the estimated capacity was placed so high that it did not become necessary to form the new company and relinquish the works. In more recent years, however, such contracts have been executed and the capacity fixed by the company in good faith and have been extensively used, not only in Colorado but in Nebraska and Oregon also.

The Regulation of Commercial Enterprises.

At an early date statutes were passed in a number of the western states authorizing the county supervisors, or commissioners, to fix the rate at which commercial enterprises should furnish water to irrigators. (The statutes of the last session in some of the states transfer this power to the railroad or public service commissioner.) In the absence of such rate fixing the rates established by the water company controlled. The state and federal courts in California have vacillated in their determination as to whether rates agreed upon in formal water right contracts, executed prior to the rate fixing by the county board, should be enforced after lower rates had been fixed by such board. On March 2, 1897, the California legislature amended the act providing for such regulation by adding a new section expressly stating that nothing in the original act shall be construed to "invalidate any contract already made." The new section was interpreted by the California Supreme Court in Stanislaus Water Company v. Bachman (152 Cal. 716); wherein it was held, "And under the present statute the contract rights prevail in all cases, the boards of supervisors being powerless to effect or interfere with them."

In the more recent case of Leavitt v. Lassen Irri-

gation Company (157 Cal. 82) decided December 24, 1909, the Supreme Court said:

> The language of this court in Stanislaus Water Company v. Bachman * * * must be construed in the light of the facts there presented. * * * *
>
> If it be conceived that Section 552 Civil Code, is designed to confer upon any particular consumer any special, permanent, and preferential right above what is here stated, that effort, being plainly violative of the Constitution, would be held void. The same declaration applies to the provisions of the act entitled * * * * approved March 12, 1889, and of the amendment of that act by the act approved May 2, 1897.

The Leavitt case deals with a prior and perpetual water right reserved by the former owner (the plaintiff) in selling a commercial enterprise to the company (defendant). It seems that such an exclusive and preferential right could be easily distinguished from the ordinary water right provided for in the amendment of 1897, but as so many capable attorneys hold to the contrary it would be unwise to organize an irrigation company with the idea of establishing by contract profitable rates which could not be lowered by the county supervisors.

Who Owns the Water Right.

The expression "selling water" is so commonly used that few laymen ever doubt that the irrigation company is the owner of the water right and that, in selling its system or in rate fixing, it is entitled to a considerable sum for such right. It is surprising to most, therefore, to learn that the Supreme Court of Colorado, so long ago as 1887, in Wheeler v Northern Colorado Irrigation Company (17 Pac. 487) said:

> It (the irrigation company) exists largely for the benefit of others; being engaged in the business of transporting, for hire, water owned by the public to the people owning the right to its use.

The question was not a direct issue in California until the recent case of San Joaquin & Kings River Canal and Irrigation Company v. Stanislaus County (191 Fed. 875) decided September 18, 1911. The company had brought suit against the county to enjoin the enforcement of water rates fixed by the County Supervisors. One of its contentions was that its water rights were worth $1,000,000, and that nothing had been allowed for them in the Supervisors' valuation. After a careful consideration of the authorities, Judge Morrow refused to accept the contention in the following words:

> The claim, as stated, is manifestly not sufficient to state a right of diversion. It must appear, further, that the complainant is either the owner of land for which the water is being appropriated for a beneficial use, or that the water is being diverted for the purpose of being carried by the complainant to consumers who own land for which the water is being appropriated for a beneficial use, and that the water is being so used. The complainant in this case is not the owner of any land for which the water is being appropriated. The complainant's right to divert the water of the river is therefore based upon and is measured and limited by the beneficial use of certain consumers for which the water is being appropriated. But, if the amount required by these consumers for a beneficial use is not 1350 cubic feet of water per second, then complainant has no right to divert that quantity of water; or if, for example, these consumers require only 100 cubic feet per second for beneficial use, then that would be the basis and measure and limit of complainant's right to divert water from the river, and not the capacity of complainant's headworks, canals and ditches used in making such diversion. The water right must, therefore, be the right of the consumer and attached to his land, and not the right of the complainant attached to its canal system.

The irrigation company has appealed to the Circuit Court of Appeals and the case will probably be carried to the Supreme Court of the United States. The reader is referred to the opinion as an excellent exposition of the principles underlying not only the question of ownership of water rights but also the many other questions regarding rate fixing for public utilities.

As the cases now stand the Supreme Courts of Arizona, Colorado and Nebraska and the U. S. Circuit Court in California positively hold that the water right belongs to the user and not to the irrigation company. The only Supreme Court indicating to the contrary is that of Montana in Bailey v. Tintinger (122 Pac. 575) decided March 5, 1912. The case was simply one to determine the relative rights of a number of ditch owners and the Court, instead of applying the accepted rule that every appropriator must be given a reasonable time after the completion of the ditch in which to apply the water to beneficial use, holds that under the Montana statutes the appropriation must be considered complete upon the completion of the ditch. In the course of its opinion the court says:

> To deny the right of a public service corporation to make an appropriation independently of its users or future customers * * * would be to discourage the formation of such corporations and greatly retard the reclamation of arid lands in localities where the magnitude of the undertaking is too great for individual enterprise.

In view of the issue before the court the above expression should be considered a dictum only. It is another illustration of the dire need of rational water right legislation in Montana.

A further statement of the present and future status of commercial irrigation enterprises will be made in a later article after the discussion of other types of irrigation enterprises.

STREET RAILWAY PRACTICES IN GERMANY.

By Vice Consul General We Witt C. Poole, Jr., Berlin

I am reliably informed that no assessment of the cost of street railway extensions on the property supposed to be benefited thereby is made in Berlin. Real estate development interests not infrequently approach the local street railway companies on the subject of extensions into the locality which it is desired to develop. In these cases the street railway companies usually demand a guaranty of earnings for a limited period, contracting sometimes for compensation in accordance with transportation facilities offered. Thirty-five pfennigs (8 1-3 cents) per car-kilometer (kilometer = 0.62 mile) is a rate of compensation frequently agreed upon. These are, however, purely voluntary arrangements.

It is usual in Germany for street railway companies to pay a certain portion of their gross earnings to the municipality within the jurisdiction of which they operate. In Berlin the portion is at present 8 per cent. The franchise is in the nature of a contract, and the city stipulates for an option to take over the entire street railway property at a prearranged price on the expiration of the franchise.

DRAFTING ROOM PRACTICE, V.

BY A. L. MENZIN.

Drawing Details.

Fig. 1 shows the practice of a large American firm in the detailing of structural steelwork. Instead of placing the dimensions between arrow-heads, as is customary, the dimensions are placed above the dimension lines. Fractions are written without the intervening line and inch marks are omitted where no uncertainty can result from the omission. Side views of rivets are not shown. Open holes and the different kinds of rivet heads are indicated by employing the conventional signs given in handbooks of the manufacturers of structural steel. Thus in Fig. 1, the rivets in the column footing are to have countersunk and chipped heads on the bottom face. All other heads are to be full. Certain holes in the angle connections at the top of the column are to be left open for field work. The practice illustrated in this drawing is conducive to great clearness and permits of very rapid detailing.

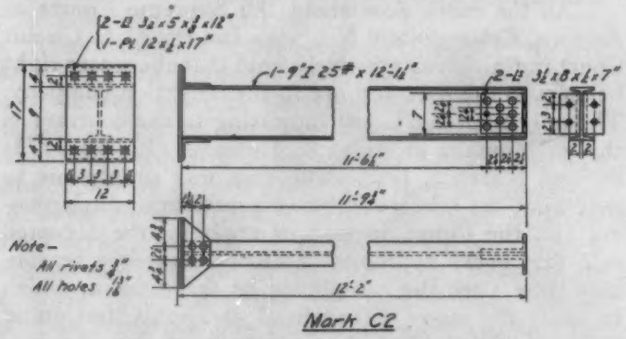


Fig. 1. Structural Steel Work Detail.

The making of piping drawings is another class of work in which conventional representations may be used to advantage. The outline drawings of valves and screwed fittings given in catalogues of the manufacturers contain too many lines to be suitable for ordinary working drawings. The outline drawings for flanged fittings are very simple and are usually copied as given. Simplified drawings of valves and screwed fittings suitable for working drawings are given in Fig. 2.

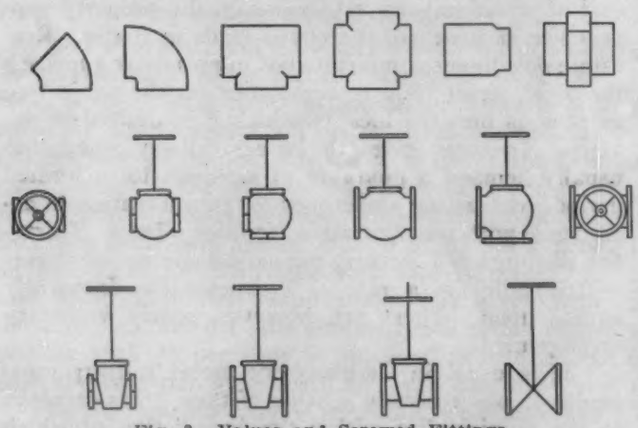


Fig. 2. Valves and Screwed Fittings.

The drawings in the upper row, with the exception of the last, which represents a screwed union, are imitations of plain gas fittings, but may be used to represent beaded fittings as well, since specifications for the particular kind of fittings to be furnished are usually given on the drawing or elsewhere.

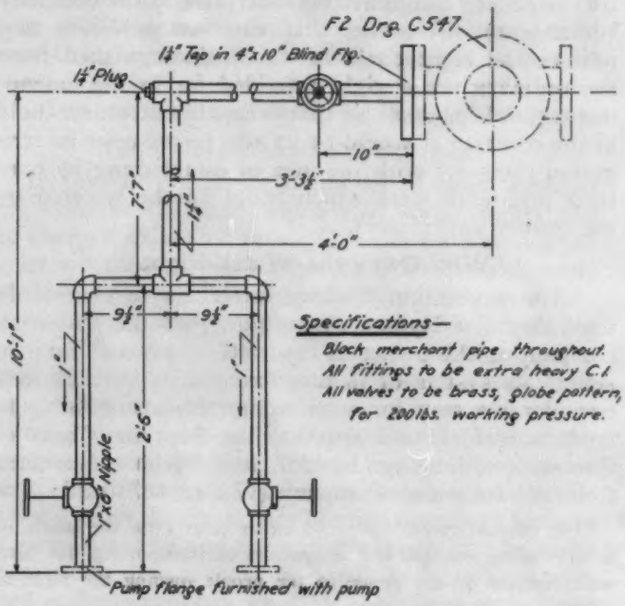


Fig. 3. Flange Piping Details.

The drawings for the valves are self-explanatory, with the exception of the last two in the bottom row. The next to the last drawing indicates a gate valve with a rising stem. The last drawing shows a way of representing both gate and globe valves in common use.

Fig. 3 shows the detailing of flanged piping. In this class of work the dimensions given are from center to face of fittings and angle valves, and from face to face of opposite flanges on straight pipe. Face to face dimensions of globe and gate valves are also given. To facilitate erection, marks for each individual piece are shown. Parts of the same kind and size should bear the same mark, since this practice simplifies the bill of materials and also saves the erector unnecessary work.

It is often desirable, to avoid drawing auxiliary views, to show a piping lay-out in a single view. This may be done by imagining certain parts to be rotated so that all of the piping will lie in the same plane. Thus in Fig. 3, the bends P7 and P8, have been rotated 90 degrees to bring them in the same plane with the other piping. A correct arrangement of the piping should be shown on the general assembly drawing, or else notes should be placed on piping out of position to indicate how it is to be erected.

Detailed drawings of screwed piping, such as Fig. 4, show center to center dimensions for all valves and fittings, or else the lengths of connecting nipples are given.

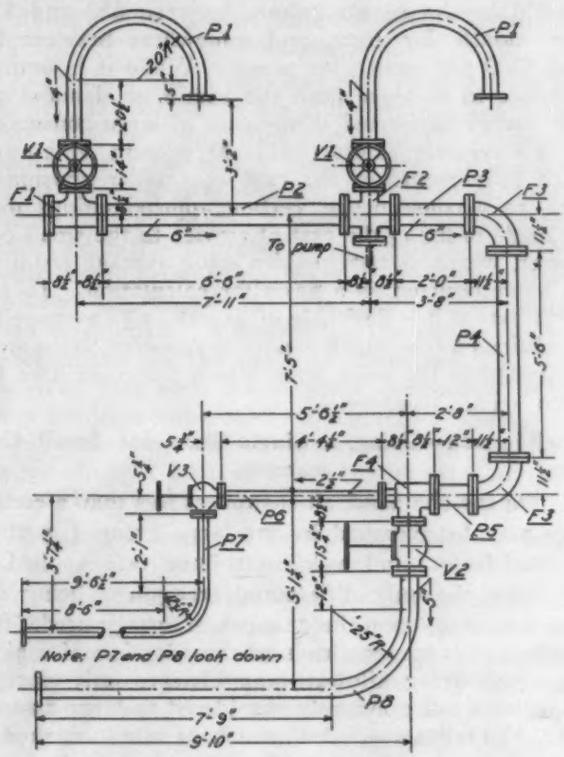


Fig. 4. Piping Conventions.

Fig. 4 also shows one way of indicating the connection between piping shown on different drawings. The relation between the piping shown in Fig. 3 with that shown in Fig. 4 is indicated in Fig. 4 by reproducing the fitting F2 in phantom lines and giving its mark and drawing number.

ELECTRICAL INSTRUMENTS IN ENGLAND.

American tourists have long wondered at the popularity of the tumbler switch for turning on and off the lights in rooms of English hotels. That Englishmen visiting America have assumed the same attitude toward our push-button switches is asserted in a monograph on English electrical instruments just issued by the Bureau of Manufactures at Washington, as a result of investigations by H. B. Brooks, commercial agent of the Department of Commerce and Labor. The relative merits of the two systems is discussed in the pamphlet, and several arguments in favor of the American device are put forward.

In the same bulletin it is asserted that English girls have failed to give satisfaction at such work as winding coils and calibrating instruments. The English manufacturer is of the opinion that the girls do well at light routine work, but are content to go on year after year performing the same tasks. For example, a girl may be taught to calibrate 100-ampere ammeters, and will do well on a lot of these, but if she is to do such instruments one day, and another sort the next, and so on, she requires too much superintendence.

In one of the largest electrical works in England the time-limit system is used in the testing room. Thus, if eight hours is the alloted time for a particular piece of work and a man does it in six, he is paid for one of the hours saved and the firm saves the other. In this shop the average instrument worker earns sixteen to eighteen cents an hour, while some of the highest class men make twenty to twenty-four cents. The works of seven of the leading electrical firms in England are dealt with in the same publication.

ELECTRICAL APPLIANCES IN THE HOME.

The Wall-street Journal recently commented editorially on the exploitation of electrical appliances in the home. Our own views may be found on the editorial page, while the editorial matter referred to is as follows:

Electrical manufacturing companies are spending much money at the present time in advertising household appliances and luxuries. This is an increasingly promising policy and is resulting in a considerable growth of business. Sales of electrical conveniences for the home are running 40 per cent higher this year than last. Factories are busy turning out irons, toasters, water heaters, hair curlers and the many little luxuries of life, while new manufacturing facilities are being planned. The effect upon the earnings of producing companies will soon begin to show in annual reports.

Another campaign, secondary to advertising, would be well worth the consideration of manufacturing concerns. This is to establish cheaper rates for domestic consumers. No one who has looked into the matter at all would deny the advantages of electrical appliances in the house. Nor is it the cost of the utensils that retards their wider use. It is the high cost of operation that causes hesitation. With current selling at 10 cents per kilowatt, it costs about 4 cents an hour to use an electric iron. Toasters and cooking devices cost even more. The would-be user of moderate means is appalled by the expense. The chief of the household department of one of the largest manufacturing companies once sized up the expense: "Any man who can afford to maintain a high-powered touring car can afford to cook by electricity." To a large percentage of the population this means prohibition.

If the manufacturing companies would really give a boost to the use of these conveniences, let them enter the campaign to reduce the charge for current to something like a reasonable comparison with the cost of manufacture. When energy can be made for less than one cent, it is demanding an undue profit to charge the consumer ten cents. The great manufacturing concerns, which are financially interested in many of the light and power companies, could force a reduction if they took up the campaign in earnest.

Such reductions would benefit all concerned. The sale of appliances would be multiplied; the citizen would have more sanitary, cleanly and satisfactory service, and the generating company would have an increase in consumption and a distribution of load that would swell rather than curtail net profits. If manufacturers really want to increase sales, let them consider this method of adding to the circle of possible users. There is no better way to create a market.

REPORT OF THE N. E. L. A. RATE RESEARCH COMMITTEE.

General.

The great necessity of adopting as rapidly as possible, uniform methods of charging for central-station service has already been pointed out. It is not alone sufficient that some general policy of rate making be recognized by the several companies, but it is very desirable that the actual form in which the rates are placed before the public should be as nearly alike as possible.

The committee believes that retail rates quoted in schedules may be gross rates, subject to a moderate cash discount for payment within fifteen days or less from date of bill. Giving half the cash discount during the succeeding ten days has been adopted by some companies and found to expedite collections and promote friendly relations with the consumer.

The specific recommendations of the committee regarding forms of rates to be considered for the several distinct classes of customers are given herewith.

Customers of Large Size.

The committee agrees unanimously in recommending that all large customers be charged on a schedule making separate and distinct demand and energy charges. The unit charges per kilowatt of annual maximum demand and per kilowatt-hour consumed may be made to decrease respectively with an increase in the number of units of annual maximum demand, and the number of units of energy consumed monthly, according to a block system, applying to both the demand and energy charges. By allowing the unit charges to decrease in this way the equivalent of a customer charge is worked into the rate schedule.

Feature Rates.

The committee believes that for storage battery charging, for refrigeration and for other similar classes of business still lower rates can properly be made, for which separate schedules may be desirable.

Lamp Renewals.

The committee believes that it is for the best interest of central stations and the public that the rate for electricity should be such as to permit the free renewal of standard lamps and the offering of other lamps at such low prices as to prevent dealers from competing with inferior lamps; or, if this policy is not adopted, the offering of lamps only at such prices as to encourage dealers to compete with a good quality of lamp.

Minima.

There should be an appropriate minimum charge per customer. There should be a minimum charge per kilowatt for auxiliary or break-down service. There should be a guarantee of income in contracts which require extensions to plant or lines and which might otherwise be unprofitable.

Subject to these minima, the company should have for ordinary conditions a maximum rate per kilowatt-hour.

Modification Necessary for Small Consumers.

Differences of opinion exist in regard to the modifications that should be introduced when the size of the customer to whom the demand rate for large customers applies decreases to a certain limit, the value of which is also open to discussion. The line of demarcation between large and small consumers should be drawn somewhere between $50 and $200 per month for light, and somewhere between $10 and $100 per month for power. While it is entirely possible to measure both the maximum demand and the energy consumed in the case of large consumers, it is obviously impracticable at present to go into such refinements in the case of smaller consumers, and, as a consequence, certain approximations must be made in fixing the cost of service to the small consumer, which in turn require some average condition to be recognized as a basis for calculation. To just what extent it is desirable or necessary to average the conditions under which service is rendered to the small consumer is the point upon which the committee has been unable to agree.

Modification—Using a Single Rate for Small Consumers.

On the one hand, all customers less than a certain size may be averaged in one large group regardless of load-factor, and a kilowatt-hour rate applied to all alike, the only differential recognized being one based entirely upon the quantity of energy used. This method of treatment leads to the adoption of a block rate embodying kilowatt-hour charges only for all consumers not previously considered as large customers. The reduction in kilowatt-hour rate to customers using fairly large quantities of energy has the effect of introducing into their bills the equivalent of a customer charge. The general level of the kilowatt-hour charges in this rate would, of course, be higher than in the case of the rate for large consumers, in order to cover the demand and customer charges involved in rendering service to the average small consumer. This rate should carry with it a suitable form of minimum. The first step in such a block rate could include so many kilowatt-hours that the average residential consumer would receive his entire energy-supply at a straight-line meter rate, thus presenting to him an extremely simple rate and one that he can readily understand. As this rate gives to all small consumers, both residential and commercial, a charge based entirely on a quantity of energy consumed each month larger than the average residential customer is likely to use, it does not offer him a very great incentive to adopt any of the electrical devices which add so greatly to the convenience and utility of electric service.

Modification—Using a Two-Charge Rate for Small Consumers.

The desirability of more strongly encouraging long-hour use of service has led, on the other hand, to the recognition of a rate which will give even the smallest consumer the advantage of a decreasing unit-charge for energy with increasing load-factor. To accomplish this a two-charge system which recognizes the demand and the energy consumption as independent elements in the cost of service is required, as in the case of the large consumer. Under such a system the small customer receives a like benefit of

long-hour use of his service, even where the quantity of energy consumed would of itself not warrant a reduction in his unit-charge under the block kilowatt-hour rate.

Form of Two-Charge Rate for Small Commercial Consumers.

In order that a customer may receive some benefit from the long-hour use of his service, a differential rate must be established involving the elements of both demand and energy consumption. In the case of small commercial consumers, a majority of the Committee recommend that a method of charging apply as indicated in the schedule of rates shown on Sheet 2, with the understanding that the electrical demand (always measured in the case of the large consumer) may be estimated, if desired, for the small commercial installations on the basis of connected load. It is believed that even the smallest commercial installation would accept a rate, making separate demand and energy charges, without question, and as such a rate is the simplest form of a two-charge rate it is recommended for adoption wherever possible.

Demand Element in Two-Charge Rate for Small Consumers.

While it is believed by many that the actual measured electrical demand of the small consumer is the theoretically correct demand basis of a two-charge rate, and that it will ultimately prove to be the general basis used, there are certain reasons why such an electrical basis of demand rating cannot be adopted exclusively for commercial use at the present time.

First.—There is at the present moment no reliable device on the market for measuring electrical demand generally at a cost sufficiently low to admit of its application to consumers of small size.

Second.—In residential service, the lighting demand constitutes at present the greatest **average** demand, but it by no means represents the greatest individual maximum demand, taking into account the use of heating and cooking devices and other power applications. However, the diversity-factor applying to the use of such apparatus is so great at present that it is not deemed wise to adjust the demand charges, properly determined by the lighting load, on a basis which would at this time include other applications of service. When these other applications become of more than incidental importance in affecting the demand of any individual group of customers, they should properly be considered in establishing the electrical demand as a basis for rates. Until that time arrives the fact that the heating and cooking devices are used on the customer's lighting circuits makes it impracticable to separately measure or control the lighting demand without also bringing the heating and cooking demand into consideration, which, as just pointed out, is not a desirable thing to do at present.

Form of Two-Charge Rate for Residential Consumers.

In the case of residential service, it is not considered advisable to attempt to make separate and distinct demand and energy charges, for, to the residential consumer, whose use of service may vary greatly from month to month, a fixed monthly demand or "service charge," as he regards it, appears very burdensome and unjust. In order to overcome this objectionable feature it is recommended that a rate involving the use of a certain amount of energy, as explained later, at a primary rate per kilowatt-hour each month before a lower secondary rate applies, and embodying a suitable minimum, be adopted for residential service.

Two-Charge Rate for Residential Consumers.

Under the form of a two-charge rate recommended for residence business, the customer pays for a certain number of kilowatt-hours consumed each month at a primary rate, and for all kilowatt-hours in excess of this quantity at a lower or secondary rate. In some cases a still lower tertiary rate is applied to all energy consumed in excess of the amount required at a primary and secondary rate. The number of kilowatt-hours that must be consumed at each higher rate before the next lower rate applies ordinarily depends upon the customer's demand. By making the number of units to be used at the primary rate equal to a constant plus some function of the consumer's demand, or by decreasing the number of hours' use of demand at the primary rate as the demand increases, the equivalent of a customer charge is embodied in the schedule. The action of this rate is obvious. The fixed charges are covered by the difference between the low final rate and the primary rate which applies to the predetermined quantity of energy used at the primary rate.

Minimum Demand in Two-Charge Rate for Small Consumers.

While the demand for small consumers should be based primarily on electrical demand, there are excellent reasons for establishing certain minimum values of demand for these consumers, depending, in the case of commercial service, on the connected load, and, in residential service, on the floor area or number of rooms. It is the understanding that in ordinary cases the demand as established by this minimum will be used in place of the measured electrical demand, thus not only saving a great deal of expense by eliminating measurement of the demand of the small customer, but at the same time assuring the station a minimum return from the small consumer which is to some degree fixed by the value of the service to him.

Lamp Efficiency and Minimum Demand.

A very important reason for establishing a minimum demand to apply to the small customer served on a two-charge system is involved with the efficiency with which energy is utilized in lighting. The efficiency of light production is unsettled, not only because changes are now being generally made by customers to the more efficient types of incandescent lamp, but also because lamps of lower wattage and higher efficiencies seem inevitable. Until the probable limit of development can be more fully predicted, or until the growth of other applications of service makes the lighting demand of incidental importance, the central-station's fixed service and demand charges must be protected by the rate schedule. It is obvious that the fixed charges of central stations would be reduced by any general and sudden decrease in the present electrical demand, which would simply leave a portion of the generating equipment idle, and as such a general

reduction is at least not beyond the bounds of probability as long as the lighting service retains its present importance; and the incandescent lamp seems capable of so much further improvement, it is advisable to provide a minimum below which the electrical demand shall not fall in the case of each consumer, such minimum being based on some approximate measure of the value of his lighting service. For residential customers, this general idea finds expression in rates involving the use of floor area or active rooms, as in Detroit, Milwaukee, St. Louis and Toronto.

Rate for Very Small Consumers.

In certain sections of the country local conditions indicate the necessity of providing an extremely cheap and simple method of serving consumers of very small size. Consumers whose maximum demand would fall between 100 and 300 watts could probably be charged on a pure demand rate, the demand being controlled by some form of current limiting device, several types of which are on the market. The customer under such a rate pays a fixed monthly charge per watt of maximum demand for which his controller is set. Theoretically the unit demand-charge should decrease with the size of the customer, in order to provide the equivalent of a customer charge (as in the rates for large users), but practically it is hardly necessary to go into such detail. Under such a rate the customer's bill is the same from month to month, which meets with his approval, the billing is simplified and the periodic reading of meters as well as a large part of the meter expense is eliminated.

Desirability of Having Controlled Flat Rate for Very Small Customers.

A demand rate for the very small consumer will generally serve to introduce electric service where it would otherwise remain unknown, and as the consumer grows in size or wishes to take advantage of heating and cooking devices he will naturally be transferred to rates that permit of their use. It must be distinctly remembered that, while there may be many localities where the need of such a rate is not felt, in many others it would prove profitable. The Committee, in attempting to make its report of widest and most general use, has of necessity adopted several viewpoints and endeavored to recommend as few rates as possible to cover the fundamentally different local conditions which it recognizes as existing.

CONSUMER.	TYPE OF RATE RECOMMENDED	
Large Consumers, Lighting and Power.	A block rate making separate demand and energy charges.	
	Either	or
Small Consumers, Commercial, Lighting and Power.	A block rate making separate demand and energy charges.	A straight line or block rate carrying kw. - hrs. charges only.
	Based on electrical demand with a minimum demand.	Suitable minimum.
	Either	and/or
Small Consumers, Residential.	A two-charge rate based on demand, with a minimum demand estimated on a floor area or room basis.	A straight line or block rate carrying kw. - hrs. charges only.
		Suitable minimum.
or Very Small Residences.	A demand - rate based on controlled or limited demand.	———

STRENGTH OF CROSS-ARMS.

An interesting investigation on the strength of cross-arms has just been completed by the Forest Service, the details of which are given in Circular No. 204:

Cross-arms must resist forces which are variable in amount and direction. In a line the arms may be subjected to heavy loads under several conditions:

(1) If the wires on one side of a pole are broken, a heavy side pull comes on the cross-arm from the other side. This causes a severe stress in the pole, and, as will be shown later, the pole is more likely to be broken than the cross-arm.

(2) If the wires are heavily covered with sleet and there is a strong wind blowing, there is a pressure on the cross-arms, but here again the stress in the pole will cause it to fall before the cross-arm will give way. Similarly, in changes of direction in the line the sidewise pull of the wires is more severe on the poles than on the arms.

(3) If the cross-arms are at the same level in the line, they can receive no greater strains than those which may be imposed by the weight of the wires, and of adhering ice, and by wind pressure. If, however, the middle pole of three is higher than the poles on either side and the wires are tightly stretched, there is a strong downward pull on the cross-arms. A similar condition might result if a single pole were left standing in a line where the pole on either side had fallen.

The average load borne by the Southern white cedar cross-arms, the weakest group, was 5000 pounds, the load being applied vertically. By careful estimate the resistance of these arms to side pull is at least 4000 pounds. Under any conditions of service this is more than sufficient, because it is so much greater than the side load that can be sustained by poles. In tests these have not withstood an average side pull of much more than 3000 pounds, and usually have failed at less than 2000. Further, both the pole and cross-arm tests were made on air-dry material, while under actual conditions of use the poles would be weakened by moisture much more than the cross-arms.

In the case of sleet or snow, if the ice coating on the wires gives each strand a diameter of 1 inch, a wind pressure of 27 pounds per square foot would be sufficient to break the pole, assuming that the poles have a resistance to side pressure of 2000 pounds, and are 150 feet apart. Even under these extreme conditions the cross-arm would have to resist stresses equivalent to those imposed by a load of only 875 pounds, applied as in the tests, so that even the weakest of the arms tested would have more than sufficient strength to withstand a force which would break the average pole.

Where there are abrupt changes of grade in a line, as in the case of one pole higher than those adjacent on either side, the downward pull on the cross-arm depends on the stress of the wires and their inclination from the horizontal. If 6 No. 8 wires are stretched to their maximum strength, assumed to be 60,000 pounds per square inch, they can exert a pull of 7670 pounds. If a cross-arm on the middle pole had the average strength of Southern white cedar, it could not be broken by such a pull unless the pole were at least 45 feet higher than the two at each side, the spans being

150 feet. Such an abrupt change in grade is rare in practice. If the cross-arm were weakened to 60 per cent of its air-dry strength, which would correspond to a green or water-soaked condition, the arm would not break unless the difference in height were at least 25 feet.

All things considered, cross-arms of the species and dimensions tested are strong enough for ordinary use; with longer arms the strength is relatively of much more importance. With the standard 6-foot cross-arm, however, the question of strength need not enter into caluculations of line construction, except in the rare case of abrupt change in grade. The ability of the timber to resist decay, and methods of preventing decay, are considerations of greater importance.

TUNGSTEN AND ITS USES.

The rapid rise of the tungsten lamp makes a resume of the great industry brought to life of timely interest. E. C. Voorheis, a mining operator of Sutter Creek, California, in a recent issue of the Pacific Gas and Electric Magazine, writes regarding tungsten as follows:

California produces a great variety of minerals, including gold, diamonds and other gems, but of all the various minerals and ores which occur in the Golden State none are of greater interest than the ores of tungsten.

Tungsten has long been known to mineralogists, but the layman has only become familiar with it within recent years. It is a metallic element. It does not, however, occur in a free state, but always in combination with some mineral substance. It is found in combination with oxygen as tungstite; with calcium as sheelite; with iron as ferberite; with manganese as hubnerite, and with iron and manganese as wolframite.

Tungstite occurs only in very small quantities, usually being found in traces with the outcrops of bodies of other ores.

Scheelite is a tungstate of calcium (lime), and is one of the rarer ores. It is found mixed with the ores of bismuth, molybdenum and antimony in Australia, and, in small quantities, in other places. California enjoys the distinction of having a deposit of this ore which is unassociated with other metals, and for this reason is in great demand and is called standard quality of tungsten ore.

Ferberite is a tunstate of iron and is the form in which most of the tungsten in Colorado is obtained.

Hubnerite is a tunstate of manganese and occurs in scattered bunches throughout the Western States. It is not produced in any great quantities.

Wolframite is a tungstate of iron and manganese and varies in composition between ferberite and hubnerite. It is the most commonly known ore of tungsten.

These ores differ in appearance. Wolframite and hubnerite are dark brown to nearly black, while scheelite is white or grayish white to yellowish, some times dark gray. The chief physical property of these several ores is their great density, their unusual weight always attracting the attention of anyone who chances to find a piece while prospecting. The first two—that is, wolframite and hubnerite—are often mistaken for iron ore, but no iron ore is as heavy as either of the ores of tungsten when pure. Of the three, wolframite is the heaviest, having a specific gravity (density) of 7.2 to 7.5, whereas that of metallic iron is but 7.3, and that of hemantite 4.9 to 5.3. Hubnerite has a density of about 5, and scheelite 5.9 to 6.1. Thus, it will be seen that the tungsten minerals are all of unusual weight for their bulk, as compared with other common minerals, such as quartz which has a density of only 2.65.

Tungsten ore is mined and shipped from a great many countries, but the principal supply comes from Queensland, Portugal, Argentina and the United States. The ore is not uncommon, though tungsten is known as one of the rare metals. Deposits that can be worked at a profit, however, are very unusual. The ore almost without exception occurs in such rocks as granite, and even then under conditions which indicate that its deposition has been due to exceptionally high temperature and great pressure.

Dr. W. R. Whitney, of the General Electric Company, estimates that the saving to the consumer in the introduction of tungsten lamps is about $240,000,000 per annum.

The following is from Consul-General Robert F. Skinner, Hamburg, Germany:

Incandescent Lamp Filaments.

"'The metallic wolfram, or tungsten, used in the form of threads in incandescent lamps, is obtained from wolframate. Wolfram acid (wolfram trioxide WO_3) is imported into the United States for the manufacture of these threads. WO_3 is obtained from wolframate by heating together finely ground wolframate and HCl (hydrochloric acid); thus oxide of wolfram and soluble chlorides of Fe (iron) and Mn (manganese) are formed. The three products are carefully washed about a dozen times with water. They are then allowed to precipitate, when the water is again drawn off and fresh water added. The precipitate of wolfram oxide is dissolved in ammonia, whereby ammonium wolframite is obtained. This is filtered and heated and finally boiled together with HNO_3 (nitric acid) to remove the iron and manganese.

"Another method for the production of colloidal wolfram is to send an electric current under water through two electrodes made of metallic wolfram. In this way, small particles of wolfram are thrown off from the electrodes and form colloidal wolfram. The products of the three methods are of equal value. The wolfram thread coming out of the matrix is dried in an oven and then heated in an electric oven up to 2000 degrees C. to drive out the volatile ingredients. Then an electric current is allowed to pass through the thread in an atmosphere of indifferent gas, and the thread for the lamps is thus obtained.

"The current consumption of the wolfram lamp is from 1 to 1.3 watts per Hefner candlepower, whereas the carbon-thread lamp consumes 2.3. The disadvantages are higher prices and greater fragility of the thread. Against this, the wolfram thread has a longer life (1000 burning hours against 450 of the carbon thread lamp), and it is also much less sensitive to current fluctuations. The wolfram light also gives a better light."

JOURNAL OF ELECTRICITY
POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Electrical Appliances in the Home

No one for a moment questions the advisability of a clean-cut campaign for an increased use of electrical appliances in the home. The recent advent of the tungsten lamp, making possible the lighting of the home for far less outlay per month than formerly, necessitates new and increasing demands for power consumption by developing new applications of electric power. And, indeed, this campaign has been consistently carried on both by the manufacturer and the central station. As set forth on another page, this campaign has resulted in the sales of electrical appliances for the home showing an increase of 40 per cent during the past year.

Undoubtedly in many cases power companies could well afford to lower their rates in the effort to increase or encourage new cooking devices, which are beyond the reach of application for the average man at present, due to the non-economy resulting. It is unfortunate, however, that the writer of the article referred to, should use the misleading argument that since electrical energy can be made for less than one cent, it is demanding an undue profit to charge the consumer ten cents. Such statements as this, misleading in their character regarding public utility costs, get into the hands of the agitation-loving politician. The uninformed jump to the conclusion at once that a gigantic profit of nine cents per kilowatt-hour is being made from an outlay of one cent.

Let us for a minute analyze some of the evidence brought out in the hearing of the controversy between the Great Western Power Company and the Pacific Gas and Electric Company. It is, indeed, true that the evidence showed that power is being generated by the Pacific Gas and Electric Company, the largest hydroelectric distribution system in the world, for less than one cent. In fact, six mills is the total cost of hydroelectric power to substation without counting depreciation. Taking into account the necessary steam auxiliary service, this cost is brought up to 1.06 cents per kw.-hr. The cost of distribution, however, amounts to .505 cents per kw.-hr., and charges for depreciation and administration total 1.371 cent per kw.-hr., thus making a total of 2.936 cents per kw.-hr. The above constitutes the cost of service without profit of any nature and represents the economic results attained from a distribution so extensive that it can take advantage of every economic saving. In the city of San Francisco, where underground cables and conduits are largely required, the cost proved to be a trifle under 4 cents per kw. hr.

The economic law of cost of service is the final and equitable basis of rates. For residence distribution, the network of small meters and transformers runs the cost up much higher. Hence we condemn the misleading statement of power being generated for less than one cent as being in any way comparable to pass on the question of reasonableness of rates.

The central stations should do every reasonable thing within their power to encourage the use of electrical appliances in the home. In those States which have regulating commissions, however, where rates are scientifically based upon cost of service, it is questionable whether any material reduction would be wise. An equitable establishment of rates on the basis

of the report of the rate research committee for the N. E. L. A., an abstract of which appears elsewhere in this issue, wisely encourages larger consumption of power. This basis, founded on the fundamental economic law, will unquestionably encourage more and more the consumption of electrical energy in the home.

Irrigation by Electric Pumping Plant

In the Journal of March 2, 1912, appeared valuable data and illustrations relative to the installation of small electric pumping plants. About 25,000 horsepower of installed capacity for this purpose is now represented in the load of the Pacific Gas & Electric Company in the great central basin of California. The Southern California Edison has a load of similar gigantic proportions. Hence it is seen at a glance that the subject of pumping by electrical means is one of no small importance to western hydroelectric enterprise. Indeed when we stop to consider that in the territory now being occupied by the Great Western Power Company and the Pacific Gas & Electric Company, there are some 15,000,000 acres of arid land susceptible of successful irrigation by electrically driven pumps and that one horsepower of installed capacity is necessary for every ten acres to be irrigated, we stand aghast at the possibilities of such power consumption. As in the commercial world, when one dollar is set in motion by investment twenty more get active in allied industries, so in the irrigation enterprises, one horsepower installed for pumping leads inevitably to twenty more in caring for the enormous industries brought to life by the increased agricultural yield of a district of fertile productive soil.

It is, hence, little wonder that the subject of the use of electricity for irrigation and farming purposes was the most intensely interesting at the recent convention of the National Electric Light Association at Seattle.

An abstract of the leading paper on this subject given at the convention appeared in our last issue. In the early days of well pumping many feared that the ultimate extensive use of underground waters would tend to diminish the supply. Like the widow's cruse of oil, however, the water level seems not only to maintain itself at the original height, but in many cases the continued application of waters upon an arid section has actually raised this level much nearer the surface than formerly.

The paper on commercial irrigation enterprises by A. E. Chandler, appearing elsewhere in these columns, is instructive in comparing with the electrical pumping project detailed in our last issue. Much food for serious reflection is to be found in following up every phase of the gravity system with its various legal ramifications and that compared with the electric pump, which may be said in the parlance of the day, to be on the job day and night.

In the past many have hoped that pumping by electrically driven appartus could equal in cost the usual gravity system. Few dared to prophecy an economy could be realized in face to face competition with gravity supply. Those familiar with western irrigation projects know that forty to sixty dollars per acre is not an unusual outlay for a gravity system of supply. The former fails to figure in his costs anything else than actual outlay for maintenance. Interest and depreciation are unknown, meaningless symbols. In the case above referred to, the annual cost for water per acre for each season on the basis of 8 per cent interest on $47.20 per acre invested in the gravity system and bond interest of $1.68, together with $.40 for maintenance costs, the total of $5.85 per acre is found the result. On the other hand taking into account, interest and depreciation of the pumping station together with cost of electric power, the electrically operated system proves an expenditure of only $2.47 per acre per annum.

Such carefully compiled comparative data as this talks—and may the responsive vibration awakened be always the low hum of the busy motor aiding in reclamation of our great western empire.

What is the Correct Basis of Rates?

The mathematician endeavoring to figure out the fourth dimension is not in it with the rate specialist in his efforts to evolve a just and equitable rate schedule that takes into account all the variables and ramifications which enter into a consideration of this intricate subject.

The report of the N. E. L. A. rate research committee, marks a signal advance in establishing a uniform basis of rates. Some divergencies of opinion still exist as to the true basis upon which to build a just schedule of charges for the various classes of consumers. That system, however, which the more nearly brings about a charge for power in proportion to the actual cost of service demanded by each particular class of consumer is unquestionably the correct one. Such a system would neecssitate the consideration of at least one constant and three variable costs to meet Western conditions, as follows:

1. Cost of service depends upon a fixed rate of interest upon the entire investment plus that proportion of the cost of operation and depreciation which would be neecssary to maintain supply in readiness whether or no any of it is used.

2. Cost of service varies with the time of the day. A costly plant equipped to supply a peak for two hours each day certainly can encourage the utilization of power consumption in the "grave-yard" shift as is done in the pumping districts of the Southern Californio Edison Company at Long Beach and vicinity.

3. Cost of service varies with the season of the year. Hydroelectric power can be generated at a lower figure than steam power. Hence during the height of the hydroelectric supply power is certainly developed cheaper than at other periods.

4. Cost of service depends upon the place of distribution. The underground distribution of San Francisco, though situated in a congested district, nevertheless costs more than an overhead system in a city of moderate size such as Santa Rosa.

The California Railroad Commission has already shown originality and willingness to break away from eastern commission traditions. Their method of attack in the fixing of rates will be watched with the keenest interest.

PERSONALS.

W. H. Onken, Jr., an associate editor of the Electrical World, is a recent San Francisco visitor.

J. B. Lukes, representative of the Stone & Webster Engineering Corporation at San Francisco, is at Denver.

E. T. Jones, an electrical mechanician in the Government service, is a recent arrival from Washington, D. C.

R. D. Holabird, president of the Holabird-Reynolds Company, spent the past week at Lake Tahoe, with his family.

J. W. White, of the Vix Engineering Company, has returned to San Francisco from an extensive engineering trip.

C. P. Rhodin and T. C. Gillespie of J. G. White & Company's Pacific Coast organization, were at Los Angeles last week.

Ely C. Hutchinson of the Pelton Water Wheel Company's sales force has been spending a few days in the country.

Thomas Mirk, of Hunt, Mirk & Company, is in Southern California inspecting engineering work at Los Angeles and San Diego.

A. G. Wishon, general manager of the San Joaquin Electric Power Corporation, is a recent arrival at San Francisco from Fresno.

Wynn Meredith, of Sanderson & Porter's Pacific Coast office, will return to San Francisco next week after a trip through Mexico.

Jesse W. Churchill, one of the principal owners of the California-Oregon Power Company's system, is at San Francisco from Yreka.

Henry C. Ebert, president of the Cincinnati Car Company, who spent the past week at San Francisco, is visiting the Pacific Northwest.

C. W. McKillip, district manager for the Pacific Gas & Electric Company at Sacramento, is among the recent arrivals at San Francisco.

H. E. Warren, general superintendent of the Lombard Governor Company, is at Los Angeles on his way East after a tour of the Pacific Coast.

C. R. Ray, who has been connected for some years with electric power interests at Medford, is a recent arrival at San Francisco from Oregon.

Fred L. Webster, manager of the Allis-Chalmers Company on the Pacific Coast, has returned to San Francisco from a Southern California trip.

L. Henault, a French Government engineer in charge of roads, bridges and the canals of Paris, has been spending a few days at San Francisco.

Edwin Besuden, general sales agent of the Jewett Car Company, of Newark, Ohio, has left San Francisco for the East via Oregon and Washington.

Geo. J. Henry, Jr., hydraulic and mechanical engineer at San Francisco, is in Montana, investigating and reporting on a water power for the State.

S. N. Griffith of Fresno, Cal., who has been prominent in electric traction and oil interests, has returned to California after a tour of the Hawaiian Islands.

H. A. Everett of Willoughby, O., who has extensive electric railway interests, visited the Yosemite Valley with his party before returning to the Middle West.

J. D. Ross, superintendent of the municipal electric plant at Seattle, is visiting a number of eastern cities while returning from the national A. I. E. E. convention.

O. W. Lillard, manager of the Gould Storage Battery Company's Pacific Coast district office, has returned to San Francisco from Vancouver, B. C. His headquarters were recently removed to rooms 201-202 Rialto Building.

Count Philippe de Tristan, who represents French capital in the California-Oregon Power Company's board of directors, left during the past week on a business trip to Paris.

Chas. W. Baker, assistant engineer of the Westinghouse Machine Company, has returned to his headquarters at San Francisco after a business tour of the Pacific Coast.

Doctor Ernst J. Berg, a professor of electrical engineering at the University of Illinois, sailed on the Pacific liner Mongolia for Japan last week on a month's vacation trip.

R. J. Russell, president and general manager of the Century Electric Company, has been visiting the Pacific Coast cities since the close of the N. E. L. A. convention at Seattle. This week he will return to St. Louis from Los Angeles.

H. C. Goldrick, Pacific Coast manager for the Kellogg Switchboard & Supply Company of Chicago, has just returned from an automobile tour of Southern California, during the course of which he secured some very desirable orders.

F. G. Baum, consulting engineer, left San Francisco last Monday for a three months' tour of South America. Mr. Baum will visit the larger cities of Chile and Argentina, and will also make a trip to the headwaters of the Amazon river.

The monthly meeting of the twenty or more district managers of the Pacific Gas and Electric Company was held last week in the Pacific Building, San Francisco. **John A. Britton,** the general manager, delivered an address on the growth of the company's system.

E. K. Patton, western sales manager of the Bryant Electric Company and of the Perkins Electric Switch Manufacturing Company, is visiting the San Francisco branch office of these companies. In company with H. E. Sanderson, the Pacific Coast district manager, he will soon make his annual tour of the entire Coast.

A. B. Domonoske, instructor in mechanical engineering at the University of California, while making a recent bomb calorimeter test at the Potrero gas works of the Pacific Gas & Electric Company, underwent a severe accident from a premature explosion. He will be confined at the German Hospital for some days suffering severe burns in the hands and face.

J. W. White, chief engineer of the Vix Engineering Company, has returned to San Francisco, after spending about two months in investigating the subject of producer gas as applied to power and pumping, and visiting numerous plants in the East and Middle West. The operations of the Diesel-Willans and other gas engines, as well as the Humphrey gas pump, were investigated, with a view to ascertaining the most effective methods of utilizing California oil.

Chas. F. Uebelacher, vice-president and general manager of the Elmira (N. Y.) Water, Light & Railroad Company, **Chas. N. Black,** vice-president and general manager of the United Railroads of San Francisco, and **William von Phul,** vice-president of the American Cities Company at New Orleans, have been admitted to partnership in the firm of Ford, Bacon & Davis. Mr. Uebelacker is chief engineer for the firm. The principal branch offices of the firm at 921 Canal street, New Orleans, and 85 Second street, San Francisco, will each be in charge of a resident partner.

OBITUARY.

Richard T. Laffin, district manager of the Stone & Webster interests in the State of Washington, died June 26 at his home in Seattle, aged 49 years. He was born in Maine, and went from Boston to the Philippines to become manager of the Manila street railway system. He directed all the street railway, light, power and engineering operations of Stone & Webster on Puget Sound. Mr. Laffin was an efficient and capable public servant and his loss will be keenly felt.

ELECTRICAL CONTRACTORS' NOTES.

The Chamber of Commerce of Palo Atlo on learning that one of the contractors' sight-seeing excursions is to take in Palo Alto, have appointed a committee of seven to see that the contractors and their guests are well taken care of.

The St. James Hotel will be headquarters for the Electrical Contractors' Convention at San Jose. Reservations should be made as soon as possible.

The secretary's temporary office in the St. James Hotel will be open for the validation of railroad tickets from July 23d to July 28th. Tickets are good from July 14th to July 27th, going, and from July 24th to August 1st returning.

Newbury, Bendheim Electric Company have been awarded the electric work at the hospital at the Presidio for the sum of $9545 with an allowance of 12 cents per lb. for the old copper.

The Hicks Company have been awarded the general contract for the State Armory in San Francisco for $250,000. The General Electrical Contracting Company are the low bidders for the State's portion of the electric work and the Central Electric Company low bidders for the United States government part. The entire job amounts to about $1100.

McQUISTON ADDRESSES ADVERTISING MEN.

J. C. McQuiston, manager of publicity for Westinghouse interests, and also president of Pittsburg Publicity Association, addressed the San Francisco Advertisers' Association at its noon-day meeting Wednesday, June 26th. He dwelt upon the benefit to be derived from educational advertising on the part of large corporations. He stated that it was necessary not only to render public service, but to inform the public of the investment, risk and effort expended in rendering that service. He illustrated this point by referring to his trip across the continent, showing how a passenger could enjoy the conforts and picturesque scenery en route accepting all as a matter of course and losing sight of the tremendous sacrifice necessary to provide the roadway, the trains and equipment. When the passenger is made acquainted with figures as to the investment involved in bridging valleys, tunneling mountains and in providing luxurious trains, affording the comforts of a high class hotel, he will be less prone to criticise the corporation and more than likely wonder how it is possible to have such service rendered at such a reasonable cost.

The publishing of information calculated to educate the public as to the operations of the public service corporation is the solution of checking the antagonism on the part of the people.

Mr. McQuiston also referred to the advertising being done by large manufacturing corporations and the relation of such advertising to the local advertising of individuals and companies in cities and towns throughout the country.

He likened the advertising of the manufacturer, which is natural in scope, as being the high potential feeder and showed the advantages to be derived by distributers throughout the country, in so framing their advertising as to connect up their local effort with this national effort. He pointed out that in the broad and most comprehensive advertising, benefits must naturally accrue to the competitor, but that it was his belief that the chief aim should be to benefit the industry followed, having faith to believe that through salesmanship, that quota of return deserved and earned, would be realized. He stated that he believed that in the broadest and most beneficial advertising there was no room for petty selfishness and that we should not hesitate to carry out educational advertising campaigns, simply because in the building up of an industry, we helped competitors by the creation of a larger market. He illustrated this point in particular by referring to the advertising the Westinghouse companies are doing to encourage house wiring and to encourage the use of electrical devices in the home, and the application of electric motors to supplant antiquated methods.

He proceeded to explain the many methods being followed by the Westinghouse companies to help central station and electrical dealers to increase their business, referring specifically to the advertising helps, sent out gratuitously upon request, also Westinghouse street car cards, placards for windows, Westinghouse show window display, Westinghouse posters for bill boards and, most novel of all moving pictures embodying a great deal of human interest, showing the education of the housewife in the adaptation of electricity to the home.

These moving pictures were shown in Seattle before the employees of the electrical companies and in the month of July the same pictures wil be shown before the members of the advertising Association.

SAN FRANCISCO SECTION, A. I. E. E., MEETING.

A most interesting evening was enjoyed by the San Francisco Section of the A. I. E. E. on Friday, June 29. This, the annual meeting of year, was preceded by an informal dinner at Tait's Cafe. A letter from Ralph D. Mershon, president of the Institute, was read. Mr. Mershon requested western views of improving the Institute affairs. Recommendations were made for western membership on various committees, and it was also the sense of the meeting that one vice-president of the Institute be always chosen from western membership. A. H. Babcock, electrical engineer in charge of the Southern Pacific electrification in Alameda County, California, entertained the members with an instructive lantern slide lecture covering the essential points in his activities of suburban electrification.

TRADE NOTES.

The Great Western Power Company, San Francisco, Cal., has ordered from the General Electric Company three 750 k.v.a. 22,000/2400 volt transformers for a substation at Sacramento.

The Mount Whitney Power & Electric Company, Visalia, Cal., will install in its station a new 937 k.v.a. turbo generator, 25 kw. exciter set and switchboard, which were recently ordered from the General Electric Company.

The Yuba Construction Company, San Francisco, Cal., has recently ordered from the General Electric Company for installation on a big river dredge at Sumpter, Ore., one 200 hp. motor, six smaller induction motors ranging from 2 to 75 hp. and switchboard.

The employees of the Pacific Gas and Electric Company were entertained last Friday evening in the ballroom of the Hotel St. Francis, by the Westinghouse Electric and Manufacturing Company's stereopticon lecture, entitled "Mrs. Thrifty." The affair was well managed by the Westinghouse publicity department.

The Allis-Chalmers Company was recently awarded a contract to supply all of the transformers needed by the Coalinga Water & Electric Company for their coast extension. The transformers are to be of the outdoor type, similar to those furnished by the same company to the San Joaquin Electric Power Corporation.

McGlauflin Manufacturing Company, manufacturers of eucalyptus insulator pins at Sunnyvale, Cal., have recently shipped to the Northern Electric & Manufacturing Company at Vancouver, B. C., 3000 standard eucalyptus pins and are at present making 6000 large 12 in. pins and 1000 pole top brackets, oil treated, that go to Canadian Collieries (Dunsmuir), Union Bay, B. C.

INDUSTRIAL

MAMMOTH GENERATORS FOR GIGANTIC HYDROELECTRIC DEVELOPMENT AT KEOKUK.

In the largest power house in the world where will be wrested from the mighty Mississippi River, the "Father of Waters," the greatest single conservation of energy ever harnessed for the service of mankind, will be installed ultimately thirty immense vertical water wheel type alternating generators that rank as mammoths among machines for generating electric current. These generators will be placed in the hydroelectric power at Keokuk, Ia. When completed this building will measure 1750 ft. long by 123 ft. wide by 123 ft. high above the foundations and the plant will develop with the final entire installation over 300,000 horsepower.

One of the Mammoth Generators for the Keokuk Power House.

This gigantic concentration of energy is to reach out and wrestle with the machinery, lighting and traffic of towns and cities within a zone of 150 miles or more from Keokuk.

The great dam, the greatest power dam ever constructed, for impounding the billions of gallons of water to revolve the water wheels, or turbines, extends from Keokuk on the Iowa shore to Hamilton on the Illinois bank of the river, a distance of 4568 feet. It is surmounted by a viaduct carrying a 29 ft. roadway; rises 50 feet above the average river bed, and contains 119 spillways controlled by steel floodgates, each 30 ft. wide by 11 ft. high and operated by an electric hoist. This structure is being built in the turbulent stretch of the Mississippi River at the foot of the Des Moines Rapids, which are impassable most of the year. Constructed entirely of concrete, the dam will be the longest monolithic structure in the world, having a total overall length of 9096 ft. In the works are also included a canal lock, 110 ft. wide by 400 ft. long with a lift of 40 ft. on the Iowa side of the river and a drydock alongside the lock.

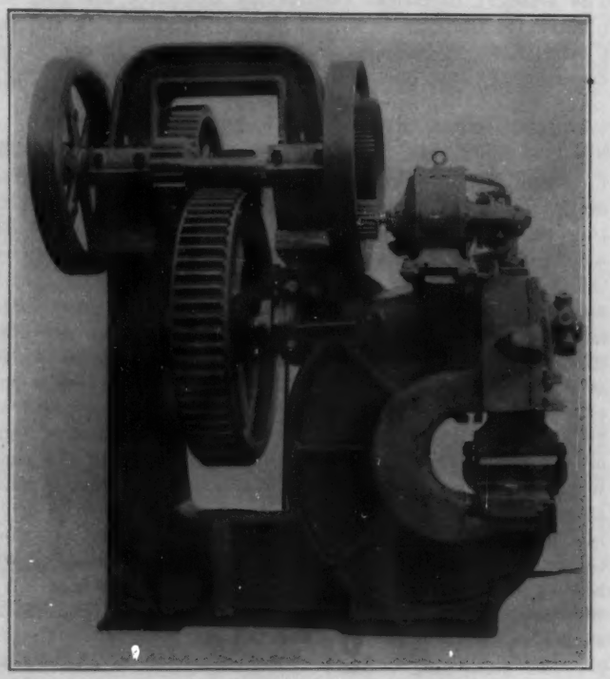
The initial installation of electric generating units will include fifteen alternators direct connected to the same number of vertical hydraulic reaction turbines of the single runner type, which will occupy the north half of the power station. Each turbine and generator will form an independent unit. Each wheel, mounted on a vertical shaft 25-in. in diameter, in a spiral chamber 21 ft. 3 in. in diameter and moulded in the concrete substructure, will operate at a constant speed of 57.7 revolutions per minute and will have a normal capacity of 10,000 horsepower.

The initial equipment will probably be in operation by the middle of 1913. St. Louis is 135 miles distant from Keokuk and is the first as well as the largest city to avail itself of the power to be transmitted over the high tension 110,000 volt lines. Street railway and electric light companies in that city have already contracted for 60,000 horsepower.

PUNCH AND SHEAR PRESS.

Economy of floor space, always an important item, is particularly so in a machine shop when it is desired to install any additional tools. The accompanying illustration will indicate how this may be effected in the case of motor-driven punch and shear press, made by the Cleveland Punch and Shear Works, Cleveland, Ohio. The arrangement of overhead gearing renders it possible to make a very compact machine and one that is economical of floor space.

The machine complete with its motor weighs approximately 50,000 pounds. It is designed for very heavy work, having sufficient capacity to shear twelve inches of 1¼ in. flat bars, and to punch a five-inch hole in 1½ in.. plate. The



Punch and Shear Press.

various attachments such as those for angle shearing, bar shearing, and punching are interchangeable.

The motor is of 25 horsepower capacity at 230 volts,, and is of the well known direct current, commutating pole type, specially adapted for this kind of work by the Westinghouse Electric & Manufacturing Company.

NEW CATALOGUES.

A. L. Ide & Sons of Springfield, Ill., the well-known manufacturers of ideal engines, have just published Bulletin No. 20 on Ideal Corliss Valve Engines. The working of the Corliss valve is illustrated in detail and will prove of interest and profit to the engineer.

The Nelson Valve Company of Philadelphia has just issued Catalogue S showing their entire line of steel valves. The catalogue is unique in that it shows steel valves made of acid open hearth steel. The arrangement of the booklet is systematic and easily accessible to architect and engineer.

G. A. Wilbur, electrical manufacturers' agent of San Francisco, is distributing bulletins Nos. 6 and 7 of the Philadelphia Electrical & Manufacturing Company. The former bulletin deals in "Pemco" tungsten arc lamps while the latter describes incandescent street lighting fixtures of similar make.

NEWS NOTES

INCORPORATIONS.

SANTA CRUZ, CAL.—The Santa Cruz Electrical Supply Company; capital $6,000, subscribed in full, by C. H. Fredson $3000, C. E. Glaine $2000 and M. L. Fredson $1000.

LOS ANGELES, CAL.—La Grande Source Water Company; capital $75,000, par value of shares $75 each; incorporators, Peter Fedderson, Henry Lassalette, Robert C. Smith.

SAN BERNARDINO, CAL.—The Limited Mutual Water Company has filed articles of incorporation; capitalization, $20,000. Directors, W. G. Herwig, Earle Mills, Silas Wright. The company will develop water near Ontario.

ILLUMINATION.

GLENDALE, CAL.—The preliminary work has started on the $15,000 ornamental electric lighting system.

HARLEM, MONT.—The Harlem Electric Light Company is about ready to begin the installation of its new plant.

NEWPORT BEACH, CAL.—The city will soon issue bonds in the sum of $64,000 for the installation of electric light and power plant.

LOS ANGELES, CAL.—Representatives of the Coalinga Water & Light Company have asked for a franchise to cover Santa Maria, Santa Ynez, and Lompoc valleys. The franchise is advertised for sale July 22.

SEATTLE, WASH.—George A. Lee, chairman of the public service commission, anonunced that the commission had allowed the Puget Sound Traction, Light & Power Company to inaugurate, without the statutory thirty-day notice, a reduction in lighting rates and other service charges.

SPOKANE, WASH.—Bids on the revised plans of the Second avenue electrolier lighting system will be received up to July 16th. The estimated cost of the lighting system is $54,485.23, of which $9365.23 is for the lamp posts and $45,120 for the portion of the current to be paid for by the property owners.

VANCOUVER, WASH.—The local gas plant, the property of the Washington-Oregon Corporation, on July 1 passed into the hands of the Pacific Power & Light Company, of Portland, a subsidiary company of the Electric Bond & Share Company, which is closely identified with the Standard Oil interests.

COLFAX, CAL.—The lighting of all the ranches between this city and Clipper Gap and the residences in Colfax, Clipper Gap, Applegate and Walmar, the summer resorts and the Sanitarium here is the object of the movement started here for the formation of an Independent Power & Lighting Company. The plan is to construct an independent pole and wire system and to generate power for lighting purposes by the use of gasoline engines.

SEATTLE, WASH.—Bids for the construction of an electric lighting system and the erection of transmission lines at the four forts comprising the Puget Sound Artillery District, viz., Worden, Flagler, Casey and Ward, were opened and awarded by U. S. Construction Quartermaster G. M. Pourie to the following contractors: Fort Casey—Construction of system, estimated cost, $34,632; bidders, Evans, Dickson Company, Tacoma, $18,296; LePage-McKenney & Co., Seattle, $11,936; Chas. C. Moore & Co., San Francisco, $4,400. Fort Flagler—Transmission lines, estimated cost, $8759; distributed among three following: Meacham & Babcock, Seattle, $4900; Evans-Dickson, Tacoma, $1504; NePage-McKenney, Seattle, $2355. Fort Worden—Entire contract, Meacham & Babcock, Seattle, for transmisison lines, cost $7212. Fort Ward—Entire contract, electric station, NePage & McKenny, Seattle, $7603.

BOISE, IDAHO—Kissel, Kinnicutt & Co., the New York bankers, have in association with important New York banking interests and John D. Ryan, president of the Amalgamated Copper Company, just organized the Idaho Railway, Light & Power Company, a $30,000,000 Maine corporation, which has acquired all the properties of the Idaho-Oregon Light & Power Company, which operates light and power and interurban lines between Caldwell and Boise City, a distance of 35 miles. The properties acquired by the new company include the following:

A hydro-electric power plant formerly owned by the Swan Falls Power Company at Swan Falls, on the Snake River, about 27 miles southwest of Boise. Present capacity 4,000 kw. This plant furnishes the Idaho-Oregon Light & Power Company with its power, and the latter company owns and operates transmission lines to Murphy, Dewey, Silver City, Nampa and Caldwell, Idaho.

The properties formerly of the Dewey Electric Light & Power Company, furnishing electric light to the city of Nampa.

The properties and franchises formerly of the Caldwell Power Company, furnishing electric light to the city of Caldwell.

An interurban trolley line (Boise & Interurban Railway), extending from Boise City to Caldwell, Idaho, about 35 miles.

An interurban trolley line extending from Boise City to Nampa, about 27 miles.

An interurban trolley line extending from Nampa to Caldwell, about eight miles.

A majority of both the $7,485,700 outstanding common stock and the $2,491,000 preferred stock of the Idaho-Oregon Light & Power Company; also about $1,443,000 of its "consolidated first and refunding mortgage" 6 per cent gold bonds, being all but about $170,000 of said issue now outstanding.

The holders of the common and preferred stocks of the Idaho-Oregon Light & Power Company have been given an opportunity to exchange their stock for the common stock and the 6 per cent preferred stock of the Idaho Railway, Light & Power Company, share for share, and the majority of this stock has already been exchanged on such basis. An opportunity is now being given to the minority holders of both classes of such stock to make a similar exchange if they so desire.

Albert H. Wiggin, president Chase National Bank, New York; Charles H. Sabin, vice-president Guaranty Trust Company, New York; John D. Ryan, president Amalgamated Copper Company, New York; Robert W. Watson, managing director Great Northern Power Company; Stacy C. Richmond, Winslow, Lanier & Co.; Samuel L. Fuller, Kissel, Kinnicutt & Co.; William Mainland, president Idaho Railway, Light & Power Company; Sinclair Mainland, director Idaho-Oregon Light & Power Company; A. E. Thompson, Oshkosh, Wis.; Grant Fitch, vice-president National Exchange Bank, Milwaukee, Wis.; R. M. Burtis, president Interstate Power Company, Oshkosh, Wis.

The banks interested are generally known as Morgan institutions.

TRANSMISSION.

LOS ANGELES, CAL.—Only twenty-two and a half miles of construction work remains to be completed on the great enterprise of 250 miles of mountains and desert bringing the Owens River through to the head of the San Fernando Valley.

LOS ANGELES, CAL.—A complete appraisal of the physical property of the Pacific Light & Power Company, one of the largest corporations in Southern California, has been begun by the valuation department of J. G. White & Company, Inc., of New York and San Francisco, and will keep a large staff of expert engineers and appraisers busy for four or five months.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has asked permission to run a transmission line from Bear Creek, in Placer County, to its north tower on the straits of Carquinez. It is intended as another trunk line feeder to its ramifying transmission system, and not to encroach upon local business en route. On that account the Commission will no doubt grant the request. Other companies are making no opposition for the same reason.

SAN BERNARDINO, CAL.—C. F. Potter, special counsel for the Southern Sierras Power Company, appeared before the Board of Public Service to urge that body to take immediate action in granting the desired rights of way across Los Angeles aqueduct lands for the transmission lines of this company. He urged that speedy action be taken as the company has had to lay off the steel structural crews and has high salaried men awaiting idle until it can proceed with the portion of construction that will have to be carried across the city's lands—a distance of about twenty-three miles.

RED BLUFF, CAL.—J. M. Eshleman and Alex Gordon, members of the State Board of Railroad Commissioners, listened here to the petition of the Northern California Power Company asking to be permitted to raise its rates outside the cities of Red Bluff, Redding, Kennett and Corning and in the towns of Cottonwood and Anderson. Up to January the company had a sharp competitor in the Sacramento Valley Power Company and the rates then prevailing were bargains for the consumers. The Northern bought the Sacramento Valley in January, and it now wants to restore rates to the non-competitive figure. The Railroad Commission, under the new law, stands in the way. The company officials claimed that the power system was worth $20,000,000, though their figures showed only $12,500,000. The big difference was explained to represent the value of water rights.

SAN FRANCISCO, CAL.—The Oro Electric Corporation, headed by J. W. Goodwin, which has plants in Butte and Plumas counties, has asked permission to extend its transmission line into Alameda County. This means it plans to compete in the sale of electric light and power in the San Francisco Bay Region. The Commission began taking testimony in the matter recently. Representatives of three other companies were there to oppose the application. H. H. Noble's Northern California Electric Company, does not want this new corporation in the section of the State where it is operating. The Pacific Gas & Electric and the Western States Gas & Electric companies are also in opposition. The former does not think this new corporation via Sacramento and Stockton into Alameda County and the bay region in general, is necessary for the public good. The Western States Gas & Electric, which is the property of a Chicago syndicate operating in and around Stockton and in Contra Costa County, wants the new company kept out of its territory.

TRANSPORTATION.

SAN DIEGO, CAL.—The street car line to Angelus Heights will soon be electricized.

KITSALANO, B. C.—The B. C. Electric Railway Company announces that new car barns and shops will be erected on the reserve here.

LOS ANGELES, CAL.—Within a short time work of installing a three-rail system on San Pedro street, in order to relieve congested traffic conditions, will be commenced by the Pacific Electric and the Los Angeles Railroad Company.

REDONDO, CAL.—Right of way has been secured and survey made by the Pacific Electric Company for a line from this city to Torrence.

VANCOUVER, WASH.—The extension of the electric line from Sifton to Hockinson, a distance of about six miles, will be made this summer.

HAMMOND, ORE.—A franchise to operate an electric railway in this city has been granted to Geo. A. Robinson, road to be completed inside of a year.

SANTA BARBARA, CAL.—Application has been made for a franchise for a street railway line in Santa Barbara. Sealed bids will be received up to July 18th.

WHEELER, ORE.—Articles of incorporation of the Nehalem Harbor Company were filed Tuesday, giving to the company authority to buy and sell real estate, build and operate water systems, build and operate electric light plants.

SEATTLE, WASH.—Ordinances introduced at the meeting of the City Council seeking to force the Puget Sound Traction, Light & Power Company to make "necessary and reasonable extensions of existing street railway lines," and to force an interchange of transfers between all street railway companies operating within the city, will be taken up for consideration next Friday morning by the franchise committee.

SACRAMENTO, CAL.—Two railroad franchises, one to the Oakland-Antioch line to operate cars on M street from the M street bridge to Third and on Third to I street and the second to the Central California Traction to extend its lines in Oak Park, on Sacramento avenue from Magnolia to Thirty-sixth and on Thirty-sixth to Park avenue were granted by a unanimous vote of the city trustees after the ordinances providing for these grants were made to conform as closely as possible with the provisions of the new city charter.

SAN FRANCISCO, CAL.—A compromise plan whereby the city will be able to operate the Geary street municipal railway upon the outer tracks in lower Market street to the ferry and the United Railroads to run Sutter street cars over the same route has been presented by Supervisor Vogelsang to other members of the public utilities committee and Mayor Rolph. Vogelsang's suggestion embraces, besides joint use of the lower Market street tracks by the Geary and Sutter street cars, a joint use of current, poles and wires in the disputed territory, the settlement of pending litigation and an exchange of transfers from the city's Geary street road to the Fillmore and Devisadero street lines of the United Railroads. It is provided that the action now pending in the United States Circuit Court be dismissed and that the city be given the right to operate in Point Lobos avenue upon the payment of the proportionate cost of construction and maintenance.

PORTLAND, ORE.—A modern electric railway terminal embracing a modern office building covering a full city block in the business district, a steel bridge across the Willamette River, a four-track system between Oswego and Aurora, electrification of 340 miles of railroad, erection of car shops, improved and rapid service between Portland and scores of communities in Western Oregon all entailing an outlay of between $18,000,000 and $28,000,000, in the next two years, are features of one of the greatest railroad development projects ever undertaken in the Pacific northwest. They are all embraced in the plans of the Southern Pacific for the territory immediately tributary to Portland. The outline of the terminal plans followed the official statement by Vice-President and General Manager E. E. Calvin that the Southern Pacific had secured the Portland, Eugene and Eastern and other Welch properties; the Salem, Falls City and Western, known as the Gerlinger road, and the Canby-Molalla road. These purchases together with the changing of the motive power of the Fourth street line and other lines radiating out of Portland, Salem, Eugene, Albany, Corvallis and McMinnville represent a cost of close to $10,000,000.